Rapidly increasing trend of recorded alcohol consumption since the end of the armed conflict in Sri Lanka

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Running head: Alcohol consumption in Sri Lanka

Keywords

Evaluation study, War exposure, Non-displaced, Conflict, Alcohol drinking, Sri Lanka

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Abstract

Aim

To evaluate temporal changes in recorded alcohol consumption in Sri Lanka during and after the armed conflict 1998 – 2013.

Methods

District level alcohol sales, and mid-year population data for the whole study period (1998-2013) were consistently available from the Department of Excise and the Department of Census and Statistics for 18 of 25 districts. These data were used to estimate the recorded per capita consumption for the areas that were not directly exposed to the armed conflict. An interrupted time series design was employed to estimate the impact of the end of the armed conflict on recorded adult per capita alcohol consumption of population lived in the 18 districts.

Results

Adult per capita recorded alcohol consumption among Sri Lankans living in the 18 districts was 1.59 litres of pure alcohol in 1998. This increased up to 2.07 litres in 2009 and 2.55 litres in 2013. Prior to the end of the conflict in 2009 adult per capita recorded consumption increased by 0.051 litres of pure alcohol per year (95% CI 0.029-0.074, $p<0.001$); after 2009 this was 0.166 litres per year (95% CI 0.095-0.236, $p<0.001$). Beer consumption showed the highest per capita growth compared with other beverages.

Conclusions

Adult per capita recorded alcohol consumption among Sri Lankans living in areas that were not directly exposed to the conflict increased markedly after the end of the conflict. Rapid socio-economic development, alcohol industry penetration and lack of alcohol control strategies during the post-conflict period may have driven this increase.

Short Summary

Adult per capita recorded alcohol consumption among Sri Lankans living in 18 districts that were not directly exposed to the armed conflict increased markedly after the end of the conflict in 2009, with a dramatic acceleration in the trend of per capita beer consumption.

Introduction

Harmful alcohol consumption causes many preventable health and social issues and around 3.3 million deaths per year globally (Rehm et al., 2009a, Rehm et al., 2009b, World Health Organization, 2014a). Sri Lanka, a South Asian lower middle-income country with a population of more than 20 million people (The World Bank), has a significant public health burden due to alcohol misuse. Around 75% of all deaths in Sri Lanka are due to non-communicable diseases such as cardiovascular disease and cancers (World Health Organization, 2014b), and alcohol misuse has been identified as one of the top five factors contributing to this disease burden (Ministry of Health, 2012, World Health Organization, 2014b). Harmful use of alcohol in Sri Lanka has also been identified as a major risk factor contributing directly and indirectly to drink-drive accidents (World Health Organization, 2014a), domestic violence (Samarasinghe, 2006), worsening poverty (Samarasinghe, 2006, Baklien and Samarasinghe, 2004), mental illness, self-harm and suicides (Jayasinghe and Foster, 2011, World Health Organization, 2014). These alcohol-related health and social issues, as well as alcohol consumption among Sri Lankans, have been increasingly reported since 2009 (Ministry of Health, 2012), when the 26-year armed conflict between Sri Lankan military forces and Liberation Tigers of Tamil Eelam (LTTE), who fought for a separate mono-ethnic Tamil state in Northern and Eastern Provinces of Sri Lanka, ended (Richards, 2014). However, the conflict mainly took place in seven of the country's 25 districts; the majority of Sri Lankans (87%) (Department of Census and Statistics, 2012) who were living in the rest of the country were not displaced or directly exposed to this conflict (Internal Displacement Monitoring Centre (IDMC), 2010, Richards, 2014).

Despite evidence of excessive alcohol consumption among military personnel (Jones and Fear, 2011), evidence of increased alcohol consumption among civilians during post-conflict periods is extremely limited due to the small number of studies, particularly in low and middle-income countries where the vast majority of on-going and previous conflicts have taken place (Weaver and Roberts, 2010, Ezard, 2012). Moreover, existing studies have mainly focused on populations directly exposed to conflicts, such as refugees or displaced persons and alcohol consumption among these populations can be increased due to individual-level factors such as gender, trauma exposure, mental illnesses, and unemployment (Weaver and Roberts, 2010, Henkel, 2011, Ezard, 2012, Roberts et al., 2014), and population level factors as mentioned below. The findings of these studies have been limited due to a lack of comparison populations and failure to use standardised and validated alcohol consumption measurement methods (Weaver and Roberts, 2010, Ezard, 2012, Roberts et al., 2014).

Alcohol consumption among nondisplaced or indirectly affected populations in post-conflict settings may also increase due to population-level factors such as rapid socio-economic development(UNDP, 2008), urbanisation(Roberts et al., 2012), lack of alcohol control strategies(Wallace and Roberts, 2013), and alcohol manufacturers and distributors taking advantage of weakened trading systems (Wallace and Roberts, 2013, Roberts et al., 2014). A few studies have identified increased alcohol consumption among non-displaced populations (DiMaggio et al., 2009), but these were based on high-income countries and their results have also been limited due to methodological issues. For example, a study conducted after the terrorist attack on September 11th, 2001 in the United States, identified an increase in alcohol

consumption among residents living in Manhattan (Vlahov et al., 2002). However, its response rate was only around 64% and it used the most basic quasi-experimental study design comparing a single measure before and after the attack (Vlahov et al., 2002). Therefore, its results may have been affected by secular trends or sudden fluctuations in the outcome measure (Wagner et al., 2002). The importance of conducting adequate research on alcohol consumption and related disorders among conflict-affected populations particularly in low and middle-income countries was emphasised by Roberts et al in 2015 (Roberts and Ezard, 2015).

Alcohol consumption among Sri Lankans has been increasing in recent years and the effect of the end of armed conflict on alcohol consumption in Sri Lanka has not yet been formally quantified and evaluated. This study aimed to evaluate the effect of the end of armed conflict in 2009 on recorded alcohol consumption among adults in the 18 districts that were not directly exposed to this conflict using interrupted time series analysis, which is considered to be the strongest quasi-experimental approach (Wagner et al., 2002).

Methods

Alcohol sales and mid-year population data

In Sri Lanka, the Department of Excise collects beverage-specific alcohol sales data from every on-trade and off-trade premise within the island. These data do not include information on unrecorded alcohol such as illicit alcohol sales or home brewed alcohol (Department of Excise-Sri Lanka). District level alcohol sales data and mid-year population data (age≥15) for the whole study period (1998-2013) were consistently available from the Department of Excise

and the Department of Census and Statistics respectively for the 18 districts that were not directly exposed to the armed conflict. These beverage-specific data (in million litres for ten types of beverages) were converted into litres of pure alcohol according to their alcohol by volume (ABV) percentage. The ABV for each drink type was determined according to the percentages used by recent national surveys (Ministry of Healthcare and Nutrition, 2008, Prasad Katulanda et al., 2014), and information given by key officials of the Department of Excise.

Recorded total per capita alcohol consumption was used as the main outcome measure and per capita consumption measures were generated by dividing annual sales in litres of pure alcohol by mid-year population estimates (age≥15). In addition, beverage specific per capita consumption was analysed for beer (7% ABV), arrack (a form of spirits with around 35% ABV) and 'other beverages'. The 'other beverages' category included the total consumption of all other types of drinks: wine (12%), whisky (40% ABV), brandy (38% ABV), gin (38% ABV), rum (37% ABV), liquors and bitters (37% ABV), vodka (40% ABV) and toddy (7% ABV).

Statistical analysis

Segmented regression, a form of interrupted time series analysis, was used to evaluate the effect of the end of the armed conflict on consumption. This method is able to estimate the magnitude of the effect of an intervention whilst controlling for existing secular trends prior to the introduction of an intervention (Wagner et al., 2002). It can identify whether an intervention had an immediate or delayed impact on an outcome measure and whether it

was a transient or longer-term effect (Wagner et al., 2002). Segmented regression was used to estimate the magnitude and timing of any change in total adult per capita alcohol consumption, and beverage specific consumption of arrack, beer and other drinks since the end of the armed conflict.

The model includes parameters representing the trend (rate of change) in per capita consumption prior to the end of armed conflict (β_1), step change in the mean level of per capita consumption immediately after the end of armed conflict (β_2), and change in the trend in per capita consumption after the end of armed conflict (β_3) (see Figure 1). The sum of β_1 and β_3 provides the post-intervention slope ($\beta_4 = \beta_1 + \beta_3$). By using this model an immediate effect of the armed conflict can be identified by an immediate step change in the mean level of consumption, whereas a gradual change in consumption over time can be identified by a change in trend.

Figure 1: Illustration of the segmented regression model

The Likelihood ratio test was used to build the final segmented regression model. The most parsimonious model was identified by backward elimination dropping any parameters that were not significant at the 5% significance level (Wagner et al., 2002). The autocorrelation function (ACF) of each parsimonious model was inspected to see whether there was any remaining autocorrelation between the model residuals at successive time points. Residuals greater than the 95% confidence intervals of an ACF represent significant autocorrelation in the dataset greater than would be expected due to chance alone(Yaffee and McGee, 2000).

However, there was no residual autocorrelation in any of the parsimonious segmented regression models and hence there was no need to adjust the models further for autocorrelation. All analyses were conducted using STATA 13 (StataCorp, 2013).

Results

Descriptive Analysis

During the study period, the majority of alcohol (in litres of pure alcohol) was sold as arrack, but it accounted for a decreasing proportion of alcohol sales over time. In 2009 arrack sales accounted for 80% of total sales in pure litres of alcohol, decreasing to 64% in 2013. Beer was the second most popular drink, and during the study period, the beer sales as a proportion of total alcohol sales increased from 15% in 2009 to 25% in 2013. Other alcoholic drinks, including toddy, wine, whisky, brandy, gin, rum, vodka, liquors and bitters made up around 5% of total alcohol sales in 2009, increased up to 11% by 2013.

As shown in Figure 2, total per capita alcohol consumption during the conflict period increased from 1.59 litres of pure alcohol in 1998 to 2.07 litres in 2009. After 2009, per capita consumption increased up to 2.56 litres of pure alcohol in 2013. As shown in Figure 3(a), per capita arrack consumption showed a gradual increase from 1.27 litres of pure alcohol in 1998 to 1.59 litres in 2009 and 1.64 litres in 2013. Per capita beer consumption increased markedly over the study period, increasing from 0.23 litres of pure alcohol in 1998 to 0.28 in 2009 and 0.63 litres in 2013 (Figure 3(b)). The increase in beer consumption during the post-conflict period alone was 125%. Per capita consumption of other alcoholic drinks showed a gradually increasing trend over time, and it increased from 0.09 litres of pure alcohol in 1998 to 0.18 in 2009 and 0.28 litres in 2013 (Figure 3(c)).

Segmented Regression Analysis

As shown in Figure 2 and Table 1, prior to the end of the armed conflict in 2009, adult per capita alcohol consumption was increasing by 0.051 litres of pure alcohol per year (95% CI 0.029-0.074, p<0.001). After 2009, there was no immediate step change in the mean level of adult per capita consumption. However, there was a significant change in the trend of per capita consumption; after the conflict, it increased by 0.166 litres of pure alcohol per year (95% CI 0.095-0.236, p<0.001), almost a three-fold increment in the increase per year compared to the trend prior to the end of the conflict.

Figure 2: Adult per capita total alcohol consumption before and after the end of armed conflict in 2009

As shown in Figure 3(a) and Table 1, prior to the end of the conflict in 2009, per capita arrack consumption increased by 0.039 litres of pure alcohol per year (95% CI 0.026-0.051, p<0.001). After 2009, there was no immediate step-level change in arrack consumption, nor a significant change in the trend.

Conversely, prior to the end of the armed conflict, per capita beer consumption was constant at around 0.29 litres of alcohol per year as shown in Figure 3(b). After 2009, there was no step-level change in beer consumption but there was a significant change in the trend, such that after the conflict consumption increased by 0.096 litres of pure alcohol per year (95% CI 0.080-0.111, p<0.001).

As shown in Figure 3(c), per capita consumption of all other drinks increased by 0.012 litres of pure alcohol per year (95% CI 0.007- 0.016, p<0.001) prior to the end of the conflict, and by 0.032 litres of pure alcohol per year (95% CI 0.017- 0.046, p<0.001) after the end of the conflict. There was no immediate step level increase in other drinks consumption after 2009.

Figure 3: Beverage specific adult per capita beer consumption before and after the end of armed conflict in 2009

Table 1: Segmented regression analysis results for per capita arrack consumption

Discussion

Recorded alcohol consumption among Sri Lankans living in areas that were not directly affected by the armed conflict increased markedly after the end of the conflict in 2009, with a dramatic acceleration in the trend of adult per capita consumption. Whilst the consumption of arrack continued to increase as steadily as it had before the conflict, per capita beer consumption increased dramatically following the end of the armed conflict with the highest per capita consumption growth rate among all types of beverages.

Economic development is known to be a key factor associated with increased alcohol consumption, particularly in low and middle-income countries (Schmidt and Room, 2012, FORUT, 2014). In line with the economic development observed in other post-conflict settings,(UNDP, 2008) Sri Lanka's economy picked up soon after the cessation of the armed conflict and achieved middle-income country status in January 2010 (UNDP, 2012). In 2011 Sri Lanka had the highest Human Development Index rank in South Asia (UNDP, 2012). The tourism industry, one of the country's main income sources, started to flourish at the end of the armed conflict. Despite a long-term history of tourism, between 1999 and 2009 international tourist arrivals grew only by 4% due to the uncertain security situation, while the global tourism growth rate was 45% (Godahewa, 2011). However, by 2013, Sri Lanka was number one in the list of best countries to travel to according to the Lonely Planet tourist guide website (Atkinson et al., 2012). Tourist arrivals increased from 0.4 million in 2009 to 1.2 million by 2013 (Sri Lanka Tourism Development Authority, 2013). At 337 billion rupees (70% increase compared to 2009), tourism's direct contribution to the Sri Lankan economy in 2013

was significant (World Travel & Tourism Council, 2014); nevertheless, as discussed below, alcohol consumption by tourists has not been sufficient to alter the trend in alcohol consumption in the country. Per capita, Gross National Income (GNI) among Sri Lankans increased from $820 per year in 1998 to $2020 in 2009 which is an increment of $100 per year (The World Bank). Since 2009 per capita GNI has increased by $368 per year up to $3490 in 2013 (The World Bank).

There is an inverted U-shape relationship between beer consumption and income. The rapid increase in beer consumption demonstrated in Sri Lanka is in line with the other low and middle income countries that have seen significant economic growth such as Russia, China and India(Colen and Swinnen, 2016). Furthermore, increased globalisation has resulted in a convergence pattern of alcohol consumption in countries around the world and traditionally beer drinking countries experience a decline in consumption whereas traditionally spirit and wine drinking countries experience an increase in beer consumption. The rapid increase in beer but not spirit consumption in Sri Lanka is also in line with this international trend (Colen and Swinnen, 2016). Sri Lanka has experienced this increase in alcohol consumption despite continuous increases in alcohol prices over time (Ministry of Finance and Planning - Sri Lanka, 2013), which is likely to be due to incomes rising faster than prices, making alcohol more affordable (Nelson, 2013, The World Bank).

In addition to the contribution from the economic development, tourists' arrival may have also contributed to the increased consumption of beer and other drinks in Sri Lanka as tourists are more likely to consume these rather than arrack. However, the influence of consumption

by tourists on the trend in annual per capita consumption measures is likely to be minimal as tourists represent a relatively small proportion each year when compared with the total population of Sri Lanka. For example, assuming that all tourists who visited Sri Lanka were adults and stayed for the whole year of 2013 (which had the highest number of tourist arrivals since the end of conflict), the total per capita consumption with and without tourists in 2013 was 2.34 and 2.56 litres of pure alcohol respectively. However, the actual impact of tourists consumption is likely to be much smaller than this as it is unlikely that all tourists are adults and their stay tends to be relatively short (Sri Lanka Tourism Development Authority, 2013). In 2013, almost 80% of tourists stayed in Sri Lanka only up to a fortnight (Sri Lanka Tourism Development Authority, 2013).

In addition to economic development, alcohol industry penetration and increased availability of alcohol during post-conflict periods have shown strong links with increased alcohol consumption in different settings (Wallace and Roberts, 2013, Roberts et al., 2014). Similarly, Sri Lanka has also become a hot spot for alcohol industry activity since 2009. Arrack and beer are largely produced by two companies. The Distilleries Company of Sri Lanka (DCSL) is the leading arrack producer with more than 75% of market share, whereas the Lion Brewery (Ceylon) PLC, partially owned by the Carlsberg Group, is the market leader of the beer industry with around 80% market share (Carlsberg Group, 2013). Both companies have seen market expansion since the end of the armed conflict. DCSL's net profit increased from 2682 million Sri Lankan Rupees in 2009 to 6873 million Rupees by 2013, an increment of 156% (Distilleries Company of Sri Lanka PLC, 2014). Lion Brewery's rapid market expansion increased its net

profit from 88 million Sri Lankan Rupees in 2009, to 1046 million Rupees by 2013, almost a 12-fold increment within 4 years (Lion Brewery (Ceylon) PLC).

The Lion Brewery used several strategies to achieve this high level of profit within a short period of time, whilst keeping beer prices attractive to both local and foreign consumers. In 2010, the Lion Brewery increased its brewing plant's capacity by 30% and in 2011 introduced a new beer brand called Corona (Lion Brewery (Ceylon) PLC). At the same time, Lion Brewery identified the growing market for beer in Sri Lanka through its market research and comparisons with other Asian countries such as India, Thailand and Vietnam, and commissioned a new brewhouse in 2012 (Lion Brewery (Ceylon) PLC). This new brewhouse was equipped with the modern facilities required to modernise and expand production to meet the increasing demand from Sri Lankans who were more likely to socialise, stay out and search for sources of enjoyment after the end of the armed conflict (Lion Brewery (Ceylon) PLC). During the same year, Lion Brewery was appointed as the sole importer and distributor of Diageo, the world largest premium alcohol beverage business selling all types of alcohol including spirits, beer, wine, whisky, vodka, rum and gin (Lion Brewery (Ceylon) PLC). All these measures taken by the beer industry in Sri Lanka likely to have increased the availability of alcohol during the post-conflict period and influenced the dramatic increase in beer consumption as well as the slight increase in consumption of other drinks.

In this context, weak law enforcement and lack of alcohol control strategies may be other reasons for this rapid increase in consumption during the post-armed conflict period in Sri Lanka (Nanayakkara et al., 2013, Dayaratne, 2013). Even though the Sri Lankan government

in power from November 2005 to January 2015 developed an alcohol control strategy and a new alcohol control act, they continued to provide licences for new liquor sales outlets and registered more alcohol producers (Department of Excise-Sri Lanka, Dayaratne, 2013). Conversely, intensive raids on illicit alcohol brewers carried out by the Excise Department and Police Department in 2010 may have forced people to consume legally-produced alcohol products which would have made a positive contribution towards the increment of recorded alcohol sales (Department of Excise-Sri Lanka).

This study's results are based on ecological data analysis thus limits the ability to establish causation between the conflict exposure and alcohol consumption. Moreover, there were only four data points to identify the per capita consumption trend after the end of armed conflict. Even though this satisfies the minimum number of data points required to carry out segmented regression analysis (Wagner et al., 2002), it was not possible to identify whether the effects of alcohol consumption identified in this study were sustained after the conflict.

Furthermore, this study did not include data from the seven districts that were directly exposed to the conflict as there were no complete and consistent alcohol sales and mid-year population data available from the government departments for these seven districts for the whole study period. However, since the end of armed conflict, a notable increase in alcohol consumption and alcohol consequences has been reported in these areas (Somasundaram and Sivayokan, 2013, Inter Press Service -News Agency, 2014). This could be due to trauma exposure (Somasundaram and Sivayokan, 2013), mental health problems (Somasundaram and Sivayokan, 2013, Siriwardhana and Wickramage, 2014), poverty and unemployment

(Siriwardhana and Wickramage, 2014, Department of Census and Statistics, 2013), removal of restrictions on selling alcohol in the armed conflict affected areas (Department of Excise-Sri Lanka), and alcohol industry penetration in these areas (Lion Brewery (Ceylon) PLC).

The alcohol sales data used in this study provided a representative dataset on recorded alcohol consumption among the 18 districts as they included alcohol sales figures from every on-trade and off-trade alcohol outlets. The recorded alcohol consumption measures of this study are therefore, largely generalizable to the areas that were not directly affected by the war in Sri Lanka. This study focused only on recorded per capita consumption due to unavailability of annual unrecorded alcohol consumption estimates from the Department of Excise or from any other data sources. However, it is known that illicit alcohol contributes to a significant amount of total alcohol consumed in Sri Lanka (Gamburd, 2008, Liyanage et al., 2012, Dayaratne, 2013, World Health Organization, 2014c). The WHO estimate of unrecorded alcohol consumption in Sri Lanka for the period from 2008-2010 was 1.5 litres of pure alcohol, which is around 40% of the total consumption for that period (World Health Organization, 2014a). Depending on the area of Sri Lanka this percentage may be as high as 60% (Abeysinghe, 2002, Baklien and Samarasinghe, 2004, Gamburd, 2008), and the trend in unrecorded alcohol consumption is increasing (World Health Organization, 2014c). Therefore, it is important to monitor not only the recorded but also unrecorded consumption using methods such as annual alcohol surveys, which would enable research into total alcohol consumption among Sri Lankans.

Rapid socio-economic development, alcohol industry penetration, weak law enforcement and lack of alcohol control strategies during the post-conflict period may have driven the rapid increase in alcohol consumption among Sri Lankans. Enforcement of existing policies and formulation of new alcohol control strategies in Sri Lanka are vital. Future research should focus on identifying the individual-level characteristics of drinkers, the average volume of total consumption (recorded and unrecorded), patterns of drinking such as binge drinking and alcohol use disorders among drinkers in the areas that were directly exposed and not exposed to the armed conflict. Such information will facilitate the successful delivery of alcohol harm reduction strategies through the identification of groups of people who are more likely to misuse alcohol and be at higher risk of experiencing alcohol-related harm.

Contributors

All authors contributed to the design of this research study. MDN conducted the analysis and produced the first draft of the manuscript, and all authors contributed to subsequent revisions and preparation of the final report. All authors read and approved the final manuscript.

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Conflict of Interest

None declared

Reference

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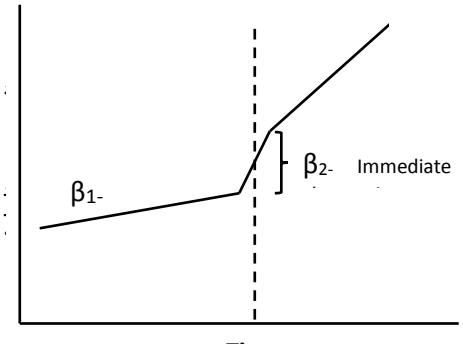
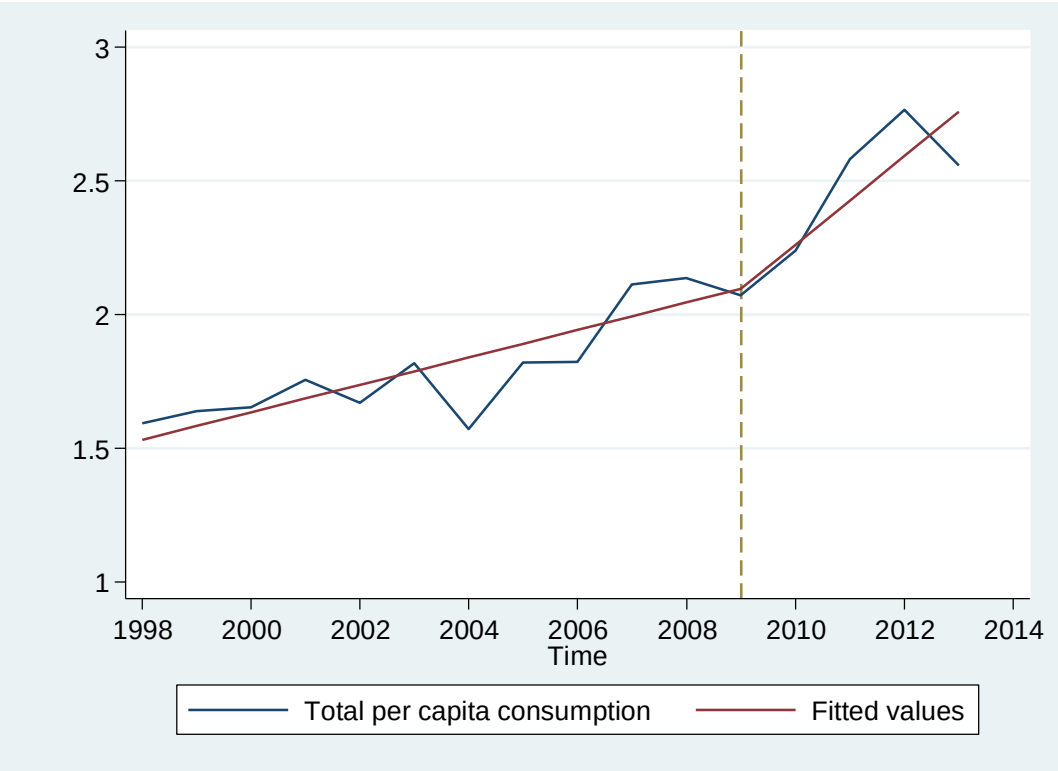
Figures and Tables

Figure 1: Illustration of the segmented regression model



β3 - Trend

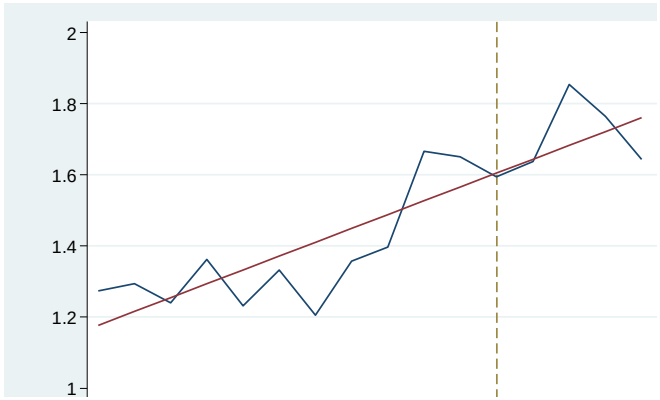
Figure 2: Adult per capita total alcohol consumption before and after the end of armed conflict in 2009



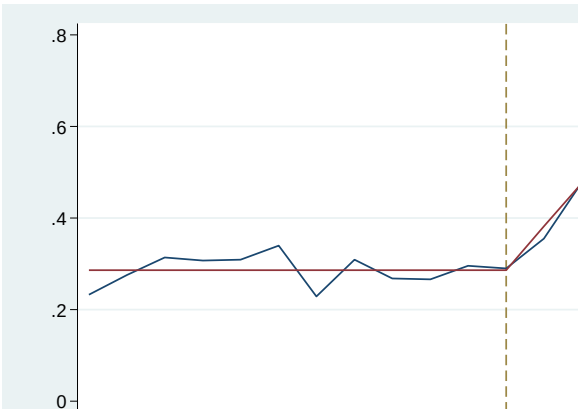
Note: Dashed line represents the end of armed conflict in 2009

Figure 3: Beverage specific adult per capita consumption before and after the end of armed conflict in 2009

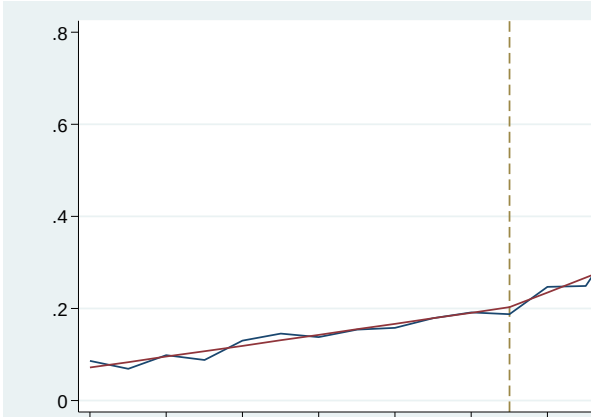
(a) Arrack(a form of spirits) per capita consumption



(b) Beer per capita consumption



(c) Other drinks per capita consumption



Note: Dashed line represents the end of armed conflict in 2009
Graphs have different y-axis scales

Table 1: Segmented regression analysis results for per capita consumption

Model	β_{1-} Annual trend prior to 2009	95% CI	p-value	β_{2-} Step level change	95% CI	p-value	β_{3} - Change in trend in 2009	95% CI	p-value	β_{4-} Annual trend after 2009	95% CI	p-value
Total Per Capita Consumption	0.051	0.029-0.074	<0.001	-	-	-	0.114	0.030 - 0.199	0.012	0.166	0.095 - 0.236	<0.001
Arrack Consumption	0.039	0.026-0.051	<0.001	-	-	-	-	-	-	-	-	-
Beer Consumption	-	-	-	-	-	-	0.096	0.080 - 0.111	<0.001	0.096	0.080 - 0.111	<0.001
Other Drinks Consumption	0.012	0.007-0.016	<0.001	-	-	-	0.020	0.003 - 0.038	0.026	0.032	0.017 - 0.046	<0.001

Note: only parameters significant in the parsimonious model included

β_{1-} Annual trend in the total per capita alcohol consumption prior to the end of armed conflict in 2009

β_{2-} Step change in the total per capita consumption immediately after the end of armed conflict in 2009

β_{3-} Absolute change in trend in the per capita consumption after the end of armed conflict in 2009, compared with the baseline trend

β_{4-} Annual trend the total per capita consumption (β_{1+} β_3) of alcohol after the end of armed conflict in 2009